come from tropical or southern countries. There is nothing distinctive in the radula or soft parts of *Gundlachia*, as far as yet observed, to separate it from the analogous *Ancylus*.

A paper which, for the first time, brings to bear on this hypothesis facts which seem to render it sufficiently acceptable to publish, has been contributed by Erland Nordenskiöld to the Zoölogische Anzeiger, XXVI, pp. 590–593, July, 1903, with seventeen figures. In this paper to which the reader may profitably refer, a process such as my hypothesis assumes is fully illustrated in *Ancylus moricandi* d'Orbigny, from the Chaco region of Brazil, up to the point of the completion of the epiphragm and the determination of the identity of the forms bearing it with the typical first year *Ancylus*. The formation of the second-year shell or *Gundlachia* by these individuals, alone remains to be demonstrated to establish the hypothesis as a fact.

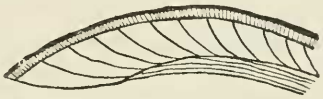
NOTES ON THE STRUCTURE OF THE SHELLS OF UNIO.

BY L. S. FRIERSON.

The shells of *Unio* are stated by most authors to be composed of three layers, known as the "epidermis," the "columnar" or "prismatic" layer, and the "nacreous," or simply called the "nacre." As a matter of fact, however, these shells are composed of four layers, the nacre being composed of two distinct layers. These may be readily noted in a polished section of some thick-shelled species, and especially if a species be chosen, such as Obovaria retusa *Lamarck*, showing the two layers in different colors. A clearer idea of the two layers may be obtained if the secreting "mantle" be studied. This part of the animal, though called by a single name "mantle" really is composed of two distinct portions, and should have two names. That portion extending from the beaks to the pallial line is thin, and one is tempted to say structureless, while from the pallial line to the margin, it is thickened, and plentifully supplied with nerves and muscles. The extreme edge of this is thickened, and secretes both the epidermal and columnar layers. From this edge to the pallial line is secreted a layer of nacreous material which may be called the extra-pallial layer. If a section of any thick-shelled species be made, it can easily be seen that the

elements of growth of this layer are *diagonal* to the general surface of the shell. From the pallial line to the beaks is deposited the fourth, or intra-pallial layer—the elements of which are parallel to the general surface. The sectionized shell will show the extra-pallial layer wedge-shaped, with the apex at beak, and base occupying the distance from the pallial line to the margin, while the intra-pallial layer is also wedge-shaped, with its apex at the pallial line.

Because the pallial line is composed of very many small muscle-scars disposed in a line, if the two layers could be separated, a sur-



face would be exposed "radially ridged." Sometimes, by decay, this separation is effected, partially, near the beaks, and the "false beaks" so exposed are strikingly "radially ridged"—so much so as to deceive an expert like Dr. Lea. If a thick-shelled *Unio* like *Quadrula trigona* be burnt, this structure can be very readily demonstrated.

It is not impossible that this appearance of decayed or fossilized *Unios* has given rise to the opinion, as stated by Mr. Chas. T. Simpson, that the primeval *Unios* were provided with "radial beak-sculpturing." The difficulty experienced by every collector of obtaining living shells showing beak-sculpturing, and the *a priori* improbability of fossil shells retaining this very perishable character, lends an air of probability to the above theory, which may be further strengthened by the curious fact that *no* North American *Unio* retains the slightest tendency to show their beaks so sculptured.

LAND SHELLS OF MT. DESERT, MAINE.

BY H. S. COLTON.

On Mt. Desert Island last summer I found land shells in six localities. At Hall's Quarries I found *Zonitoides arboreus* near the shore at the edge of the woods. From Seal Harbor I received *Vitrea hammonis* Strom, *Pyramidula striatella* Anth., *Helicodiscus lineatus* Say and *Carychium exiguum* Say. At Coryledge point under boards within a yard or two of the place where the beach began, I found